Automated Tracking Station (ATS) Product Plan

Version 1.0
April 7, 1999

Disclaimer

This document supercedes all other Product Plans and Software Development Management Plans written for the Automated Tracking Station (ATS) development effort.

The controlled copy of this document is available on-line at (http://www.wff.nasa.gov/~code584/awots.html). Printed copies of this document are for reference purposes only. It is the user's responsibility to verify that the version of any printed documentation matches the on-line version.

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1.0 Introduction

The intent of this document is to describe the approach which will be taken to accomplish the Automated Tracking Station (ATS) effort and to describe the highest level requirements which will be met. This document shall be the basis for formal agreements between the Ground Station Implementation Project Lead and the ATS development team.

1.1 Purpose

The purpose of the ATS project is to provide automation systems to the Wallops Orbital Tracking Stations (WOTS) which will enable unmanned, autonomous support of data acquisition activities for missions supported by the Wallops Flight Facility (WFF) multi-mission ground station. Currently deployed systems are as much as 30 years mature. The upgrade will integrate two existing 7.3m L/S band antennas, a new 11m S/X band antenna, and will eliminate an existing 9m S band antenna.

1.2 Background

The ATS Project, initiated in 1994, has been authorized by Code 452 strategic planning to implement automated technologies at the WOTS facility. Later modifications to this charter included the development of reusable technology for use at other existing ground stations and for future ground stations. Existing ground stations include Wallops Island, Virginia (WPS), Earth Observing System Polar Ground Stations (EPGS) at Poker Flats Research Range, Chatanika, Alaska (AGS), Longyearbyen, Svalbard, Norway (SGS) and McMurdo, Antartica (MGS).

The principal near term objective of the ATS project is to provide automation of X-Band receive and S-band command and telemetry capabilities at WFF beginning in FY 1999. The ground station development and implementation will be the responsibility of Code 452.

1.3 Product Plan Review and Update

This document shall be reviewed by members of the Ground Station Implementation Project associated with the ATS project including the Ground Station Project Lead, the Antenna COTR, Telemetry Engineers, the Engineering and Operations Interface, and the Automation Software Lead, as well as other ATS subsystem leads. Furthermore, Real-Time Software Engineering Branch managers shall review it.

This document has been developed by and shall be maintained by the Automated Tracking Station Lead. It may be updated to reflect changes in the project objectives.

2.0 Customer Agreement

This section describes the agreement between the Automated Tracking Station customer and the Automated Tracking Station development team including those issues related to requirements, deliverables, training, and maintenance.

2.1 Customer Identification

Primary customers for products developed by this effort are satellite projects such as LandSat7, ADEOS, and QuikScat. This project has relevancy to the Earth Science Enterprise and the Space Science Enterprise as defined in NASA's strategic plan.

2.2 Customer Goals and Objectives

The customer's objective with respect to the ATS is to be provided with automation software which monitors, controls, and manages missions supported by the ground station while reducing operating costs and improving availability.

2.3 Requirements

Ground station subsystems operating as a part of the ATS will operate with a high degree of autonomy such that nominal operations will require no human interaction with ground station equipment for station setup, data acquisition, data delivery, or station reporting.

Satisfaction of ADEOS, EOS-AM1, LandSat7, and other mission-specific requirements as defined in those missions' DMR documents is required. This includes requirements involving scheduling, data acquisition, spacecraft commanding and station reporting.

Due to the multi-mission design of these stations, other requirements must be met which will allow the stations to be used in support of other missions as the schedule allows.

For a detailed description of the functional requirements refer to Software Requirement documents linked to the ATS web page at (http://www.wff.nasa.gov/~code584/awots.html#Requirements).

2.4 Deliverables

The products to be delivered by the conclusion of this project include the ATS hardware and software. In addition, supporting documentation, including user's guides will be delivered.

2.5 Necessary Customer Training

The customer will be trained in mission setup procedures, normal operating procedures, and system recovery procedures.

2.6 Medium for Product Delivery

Commercial Off-the-Shelf (COTS) products incorporated into the product shall be delivered to the appropriate destination(s) as they are delivered from the vendor. Government Off-the-Shelf (GOTS) products shall be delivered on CDROM or 3.5 inch floppy disk.

2.7 Product Destination

All ground station automation hardware and software will be at the GN ground stations.

2.8 Post Delivery Maintenance

Maintenance of the ATS software will be the responsibility of the ATS development team. All modifications to ATS software required to address bug fixes, enhancements, and upgrades will be performed by or managed by the ATS team.

Installation of new software modules may be accomplished in two ways. In general, following delivery and acceptance of the systems, installation will be performed by ATS operators. Software tools and maintenance guides will be provided to simplify the process of installation.

2.9 Customer Supplied Elements

This section describes those elements of the ATS development effort that are to be supplied by the customer.

2.9.1 Funding

The customer shall provide all funding necessary to complete the project. This includes funding for all hardware, software, personnel, and facility equipment required for the project. Funding for this activity is obtained via the PCD process owned by Code 452.

2.9.2 Information and Support

The customer shall be the primary point of contact for the development of a concise list of requirements and functional specifications. Throughout the development of the ATS the customer will continue to serve as a point of contact for questions regarding detailed requirements and operation concepts. The customer shall review all ATS documentation, including requirements and design reports.

2.9.3 Test Environment

Each hardware or subsystem component submitted or procured for integration into the ATS system will be subjected to verification and validation procedures to insure compliance with both ground station requirements and project requirements.

Each software unit submitted for integration with ATS Automation Software will undergo a code review. The code review panel will consist of at least one other programmer. Prior to delivery to the ATS, all ground station automation software will be tested in the ATS Lab, a lab environment in WFF, Bldg N161, which will contain Masters, Nodes, and station equipment identical to the ATS environment. Operation in that lab will be used to evaluate performance and to obtain feedback from key personnel with engineering or operational background.

Installation of fully automated components will be tested and verified under the direction of the Engineering and Operation Interface Lead who will insure compliance with requirements in the ATS environment and will direct the use of the subsystems in Network and Mission test scenarios. Following completion of these tests, subsystems will be moved from implementation phase to operations phase under the procedures identified in the ATS Configuration Control Document identified in section 3.10 of this document.

2.10 Customer Involvement

Within Code 452, primary responsibility for ground station implementation is the responsibility of the Ground Station Implementation Project Lead. This section describes the additional areas of subsystem responsibility.

2.10.1 Antenna COTR

Garry W. Fisher, Code 452.W (Garry.W.Fisher.1@gsfc.nasa.gov)
Antenna COTR is responsible for insuring vendor compliance with NASA requirements for the 11M antenna subsystem. In addition, the Antenna COTR is responsible for notifying the vendor of changes in NASA requirements and is the single technical point of contact for performance, capability, and schedule issues relative to the delivery of the antenna subsystem.

2.10.2 Telemetry Engineers

Ronald G. Streich, CSC, Code 567.W (Ronald.G.Streich.1@gsfc.nasa.gov)
Michael R. Haugh, CSC, Code 567.W (Michael.R.Haugh.1@gsfc.nasa.gov)
The Telemetry Engineers are responsible for the implementation, documentation, and testing of installed components in the ATS. In addition, the Telemetry Engineers are responsible for the verification of component capabilities with respect to the automation of the station.

2.10.3 Technical Support

CSOC Operations (GHG and Allied Signal (ATSC))

Technical support of this effort includes a variety of functions including actual installation of equipment and racks, installation and testing of cables, computers, antennas, software and equipment troubleshooting, and other support required for the full installation and testing of the ATS components.

2.10.4 Engineering and Operations Interface

Ralph L Selby, Code 567.W (Ralph.L.Selby.2@gsfc.nasa.gov)
The Engineering and Operations Interface Lead is responsible for facilitating a smooth transition of engineered products to an operational environment. As such, the Engineering and Operations Interface verifies and validates engineering and operational requirements as well as products to insure that developed products perform as specified and that user inputs are incorporated into the coherent ATS design and implementation.

2.10.5 Automation Software Lead

David L Davis, Code 584.W (David.L.Davis.1@gsfc.nasa.gov)
The Automation Software Lead is responsible for the planning, design, and development of the ATS automation software.

2.11 Customer Communications

Communication with the customer will be carried out in a variety of forms. The ATS lead will make regular contact with the customer in order to report status, bring up development issues, and discuss design decisions. A report describing the project status, recent accomplishments, near-term plans, and problems encountered will be delivered to the customer at the end of each month.

2.12 Authority for Changes

Authority for all changes to the requirements for the project required or requested by the customer is vested in the ATS Configuration Control Board. Electronic forwarding of requirements changes via e-mail is preferred. If changes in requirements will result in a change in the ATS development schedule, the customer will be informed of the estimated impact promptly.

All changes to the design or implementation of the project required or requested by the ATS development team that may have schedule impacts will be forwarded to the customer in writing. Authorization for or concurrence with the proposed changes by the customer will be required.

2.13 Acceptance Criteria

The product will be determined to be complete when it is accepted by the customer. A formal release form signed by the ATS development team, the Ground Station Project Lead, the Antenna COTR, the Telemetry Engineers, and the Automation Software Lead will become a part of the project's quality records.

Supporting evidence of the product's readiness for acceptance will be provided by the ATS development team. A complete demonstration of the system will be performed during integration and test. This demonstration will exercise all features of the system that correspond to the documented system requirements.

2.14 Customer Agreement Review and Update Process

Changes to the requirements may be initiated by either the customer or the development team. Requested changes will be reviewed and must be approved by both the customer and the development team before they are implemented.

3.0 Management Approach

This section describes the management approach that will be employed in the ATS development effort.

3.1 General Development Approach

The lack of a COTS product capable of embracing the full compliment of new and legacy ground station systems has lead to the necessity of developing a significant portion of the automation software in-house. The most crucial driver of this effort is schedule. Reuse in other ground station and launch support systems is a secondary driver.

3.2 Resources Needed

The manpower employed to support this effort will be drawn from Wallops Flight Facility, Code 584.W, and CSOC, SODA Lab contractor personnel . Personnel assignments will be determined by agreements made between the project and the customer.

3.3 Team Organization

The Automation Software will be developed by a set of 6 teams. Each team will be comprised of two individuals. One individual will be responsible for the development of device level ("node") capabilities required by the ground station. The other individual will be responsible for the development of interface and scripting software which will ultimately control the device during supports and gather the device status for reporting.

Each team, identified as Team0 - Team5, will be assigned specific devices in a specific order. Team0 will be comprised of the individuals identified as the subsystem Master Lead and the subsystem Node Lead. This team will be responsible for the integration of the modules developed by the remaining teams. The remaining teams, Team1 - Team5 will develop control and interface software to be integrated by Team0. It is expected that as experience increases, Teams 1-5 will develop the expertise to integrate their own products into the main system. Team0 will guide this effort.

3.3.1 Team Charter

The ATS development team will provide automation systems to WOTS which will enable unmanned, autonomous support of data acquisition activities for missions supported by the WFF multi-mission ground station.

3.3.2 Team Scope

The ATS development team will procure and/or develop all hardware and software necessary for the ATS.

3.3.3 Roles, Responsibilities, Authority, Accountability

This section describes the additional areas of subsystem responsibility associated with the ATS development effort:

3.3.3.1 Subsystem Lead

Susannah A. Warner, CSC, Code 584.W (Susannah.A.Warner.1@gsfc.nasa.gov)
The Software Subsystem Lead is responsible for oversight, coordination, planning, and evaluation of automation software effort.

3.3.3.2 Master Lead

Jeffrey L. Dorman, CSC, Code 584.W (Jeffrey.L.Dorman.1@gsfc.nasa.gov)
The Master Lead is responsible for coordination, implementation, and documentation of station level monitor and control software. Specifically, the Master Lead is responsible for the integration of device-specific user interfaces into the Master Profile Editor and the Master Monitor and Control process functions and displays. In addition the Master lead is responsible for planning and implementing changes required to the Master system as a whole as a result of the specific requirements of this project.

3.3.3.3 Node Lead

Susannah A. Warner, CSC, Code 584.W (Susannah.A.Warner.1@gsfc.nasa.gov)
The Node Lead is responsible for coordination, implementation, and documentation of automation software supporting device automation. Specifically, the Node Lead is responsible for the integration of device-specific libraries and functions into the General Resource Manager (GRM) and for maintaining GRM

registries. In addition the Node Lead is responsible for planning and implementing changes required to the Node system as a whole as a result of the specific requirements of this project.

3.3.3.4 Project Interface Lead

Hayden H. Gordon, CSC, Code 584.W (Hayden.H.Gordon.1@gsfc.nasa.gov)
The Project Interface Lead is responsible for coordination, implementation and documentation of automation software interfacing with projects for scheduling or reporting purposes. Specifically the Project Interface Lead is responsible for developing specific format and protocol specifications which will allow pre-support schedule requests, ephemeris, and other support information to be ingested into the Wallops Orbital Tracking Information System (WOTIS) for scheduling and planning purposes. In addition, the Project Interface Lead is responsible for developing specific format and protocol specifications which will allow automated post support reporting communication between WOTIS and project offices.

3.3.3.5 Antenna Software Lead

David L Davis, Code 584.W (David.L.Davis.1@gsfc.nasa.gov)
The Antenna Software lead is responsible for coordination of vendor software implementation with ground station automation software implementation. Specifically, the Antenna Software Lead is responsible for tracking vendor progress and compliance with software requirements for the 11M system and its components.

3.3.3.6 Database Team

Karen F. Stewart, CSC, Code 584.W (Karen.F.Stewart.1@gsfc.nasa.gov)
This team is responsible for the implementation and management of database and database interface software which will accept and archive all communications with project offices for activities involving the ATS.

3.3.3.7 Wallops Orbital Tracking Information System (WOTIS) Team

Jeanette L. Smolinski, CSC, Code 584.W (Jeanette.L.Smolinski.1@gsfc.nasa.gov)
This team is responsible for designing, developing, and maintaining software which ingests electronic communication from the project office for activities involving the ATS. In addition, the WOTIS team is responsible for the design, development, and maintenance of software which creates data reports conforming to formats and protocols identified by the project offices for activities involving the ATS.

3.3.3.8 Real Time Software Engineering Branch

Code 584.W
The Real Time Software Engineering Branch, as the AETD provider of software engineering support for this project will provide organizational support for all aspects of the development effort. This support may include generalized development tools and development environments, documentation support, development computers, related training if available within the branch, augmentation of effort levels as required for development, internal reviews or audits, and software development standards and policies.

3.3.4 Decision Making and Conflict Resolution Process

Design decisions related to the ATS system will be made by all members of the development team. In the event of a conflict, the ATS lead will have final decision making authority.

3.3.5 External Support

Contractor support has been obtained for the requirements gathering phase of the project.

3.4 Team Interfaces

Each team, identified as Team0 - Team5, will be assigned specific devices in a specific order. Team0 will be comprised of the individuals identified as the subsystem Master Lead and the subsystem Node Lead. This team will be responsible for the integration of the modules developed by the remaining teams. The remaining teams, Team1 - Team5 will develop control and interface software to be integrated by Team0. It is expected that as experience increases, Teams 1-5 will develop the expertise to integrate their own products into the main system. Team0 will guide this effort.

3.5 Development Facilities

The ATS will be developed at Wallops Flight Facility in building N-161. Development will be conducted in a lab environment, which will contain Masters, Nodes, and station equipment identical to the ATS environment. Additional development will occur in at least one of the offices.

3.5.1 Modifications of Existing Facilities and Schedules

No modifications to the facilities will be required for this effort.

3.5.2 Development of New Facilities and Schedules

No new facilities will be required for this effort.

3.5.3 Physical Security

The N-161 lab is a secured room. Offices in N-161 remain locked when not in use. All government computers are password protected and on a government owned network.

3.6 Procurement

Purchases of hardware and/or software costing more than $2500.00 will be accomplished using the Small Purchases System (SPS). Purchases of hardware and/or software costing less than $2500.00 will be accomplished as a credit card purchase by an approved government credit card holder. All purchases will be compliant with Federal Acquisition Regulations.

3.7 Team Training Plan

No additional training specific to this project is expected.

3.8 Risk Mitigation

There are a number of risk factors associated with this effort. Management of these risks is the responsibility of the Project Lead in conjunction with the other members of the implementation team. In general there are programmatic and technical risks of varying degrees of severity. Major risk areas are identified, classified with respect to severity, and an approach to minimizing the risk is described.

3.8.1 Project Schedule

The schedule for the automation of the ATS stations is extremely aggressive. Additional manpower is not available to apply to the effort primarily because of the long learning curve inherent in dealing with large and complex systems.

3.8.2 Requirements

A detailed requirements analysis of the specific missions supported by the ground stations and the ground station functions each needs does not fully exist. As such, it is possible that work may be done which is not needed or, more seriously, some functions that are needed may not be done or done properly. A regular review of automation requirements will address this problem by forcing project managers to constantly focus on the current requirements with the aim of identifying erroneous or missing requirements as soon as possible. In addition, regular communication between the ATS Project Lead, local project interfaces, and the subsystem leads will help to resolve deficiencies in the area of requirements. In addition, one team with extensive expertise in all areas of the station design and automation software will be sent to the first installation site to install the software and make such changes as are required to complete the system on-site.

3.8.3 11M

Several failures continue to plague the 11M system and previous experience with the antenna vendor is indicative of possible problems. For instance, the ability of the antenna to report real time status parameters has not been demonstrated by the antenna vendor. This ability is clearly required in order for the project to be a success. While a network solution to this problem is desired, the fallback plan is to use the serial output from the antenna control computer to ingest the status into a Node. The node would then report the status to the controlling Master which could include the information in the real time status packet. In addition, repeated failure of antenna components (bit syncs, demodulators, etc) is expected to continue until the system stabilizes. These perturbations to schedule negatively impact the ATS schedule.

3.9 Schedule

The automation of the ground station will be accomplished through a series of phased activities. Each build will add functionality associated with additional devices or subsystems that are to be integrated into the automated system. All builds will be based on an initial set of base level functionality which is required for ADEOS support. Note that preliminary deliveries and efforts are not shown here.

For additional detail on previous efforts which contribute to the automation of the station, refer to Svalbard Ground Station / Alaska Ground Stations (SGS/AGS) Project Plans developed in support of EPGN and to ADEOS Planning Documents referenced in section 3.10 of this document.

3.10 List of Controlled Documentation

The following documents related to the ATS development effort will be controlled:

ATS Project Management Plan	822-AWT-PMP-001
ATS High Level Requirements	no identifier
ATS Detailed Design Document	no identifier
Managers Handbook for Software Development	NASA ID: SEL-84-101
Programmer's Manual	822-DDDC-PM-96
Software Developer's Manual	822-DDI-PM-97
EOS Polar Ground Network Project Management Plan	http://cnmos2.atsc.allied.com/epgs/default.html
Svalbard Ground Station (SGS) Project Plan	http://cnmos2.atsc.allied.com/epgs/default.html
Alaska Ground Station (AGS) Project Plan	http://cnmos2.atsc.allied.com/epgs/default.html

3.11 Process for Process and Product Analysis

The process of the ATS development effort will be analyzed through regular reviews of the schedule, budget, and status of the subsystems. Peer reviews and project reviews are anticipated. The product will be reviewed during formal testing. An Acceptance Test Plan for the effort is being developed and will be published on the ATS web page at (http://www.wff.nasa.gov/~code584/awots.html).
Since the ATS will be developed as an integration of COTS and GOTS products, no metrics collection and analysis is required.

4.0 Technical Approach

The general technical approach used in the automation of the Wallops Orbital Tracking Station relies on the application of a highly distributed design architecture. Each distributed unit is the result of the procurement and installation of modern, multi-mission capable telemetry equipment components. Each component is capable of fully remote controlled operation and is assigned to a specific local area of the station. Components in a local area comprise a specific subset of the functionality of the ground station (receivers, combiners, RF switches, and power meters, for example, comprise the 'Receiver' Area). The components, associated through their contributions to a specific functionality are also associated by a computer assigned to control them. This computer, which is responsible for the device level monitor and control of all equipment in a local area is called a node. A node communicates with each component in its local area and performs all setup, monitor, and control functions for specific equipment. As each local or functional area of the station is assigned to a node, the station is eventually reduced to a distributed set of node systems which are capable of exercising complete control over the equipment in their respective areas. Thus, equipment and subsystems from a wide variety of manufacturers and even legacy systems become related through a common interface – the node.

Orchestration of the station as a whole is the responsibility of a central monitor and control system – the ATS Master. A master computer is responsible for coordinating the activities of the station components using the nodes as a common interface. The master provides user interfaces, schedule ingestion, setup and scripting of pass activities, reporting, troubleshooting, and a host of other functions required for the operation of the autonomous ground station. Multiple, redundant masters are included to enhance the robustness of the system. Through extensive use of support "Profiles", a master computer is able to develop "scripts" describing the specific activities required for station setup, data acquisition, data delivery, and station reporting. Finally the central information system, WOTIS, ingests project schedule requests, distributes final schedules, and produces project-specific reports for ATS-supported missions.

4.1 Software Development Plan

Due to the lack of a COTS product capable of embracing the full compliment of new and legacy ground station systems, a significant portion of the automation software will be developed in-house. Other development may be accomplished using available software development tools.

4.1.1 Major Activities

This section describes the major activities planned in the development of the ATS. Several phases and products of the effort have been identified.

4.1.1.1 Phases

The development of the ATS will include the following phases: Requirements, Design, Procurement, Development, Integration and Test, and Installation. Detailed requirements for all elements of the ATS will be gathered during the Requirements phase. The design of the system will be developed in the Design phase. Purchase requests for all hardware and software needed to support the ATS development will be issued during the Procurement phase. The Development phase will include all ATS specific software development. During Integration and Test, the ATS will be integrated with other ATS subsystems and tested against the requirements. Installation of the system will be the last phase of this effort.

4.1.1.2 Products Associated with Phases

The Requirements phase will be complete when the Requirements and Functional Specifications document is completed and accepted.

The Design phase will be completed when the Critical Design Report has been issued and a Critical Design Review has been presented and the design accepted.

The Procurement phase will be completed when all necessary purchases have been identified and issued.

The Development phase will be completed when the hardware and software needed for the project has been obtained and integrated into a system that satisfies all requirements that can be tested without integration with other ATS subsystems.

The Integration and Test phase will be completed when the ATS Test and Verification Matrix checklist has been completed, the Acceptance Test Plan has been implemented, and a release form has been signed by the customer and the ATS development team.

The Installation phase will be completed when all ATS systems are installed at their proper locations, tested, and ready to support ATS functions.

4.1.2 Development Methodology

This section describes the methodology that will be employed in the development of this product.

4.1.2.1 Methodology

The ATS will be developed using the waterfall methodology. The product will be delivered in several phases. Periodic peer reviews will be conducted to verify the design. Prototyping will be used to verify user interface design.

4.1.2.2 Development Environment

ATS Master and Node software will be developed using the Windows NT operating system. HP-UX, UNIX workstations will be used to develop the 11M and Scheduling software.

4.1.2.3 Utilized Standards

None.

4.1.2.4 Utilized COTS Products and Tools

The HP-UX, UNIX and Microsoft Windows, NT operating systems have been included in the design. Other COTS products selected for use in the ATS project include the following: MFC/SA 11M Antenna control Subsystem, SourceSafe, ROBOHelp, and Blue Water DDK/Digiboards.

4.1.2.5 Build Strategy

The system will be built and released in several phases. Each phase will provide significant functional capability.

4.1.2.6 Product Inspection and Test Approach

Unit testing of each module will be the role of the ATS development team. Modules will be tested against documented ATS requirements.

4.1.2.7 Acceptance Criteria and Objectives

A verification checklist has been created by the development team and this checklist will be completed by the development team during the project integration and test period.

4.1.2.8 Reviews Planned

Because of the scope and complexity of the project, a number of formal reviews will be held to provide an external view of the project in terms of the requirements, the design, the implementation, and the system readiness. In addition, as the project is expected to be under development over a number of years, the implementation review process will consist of a series of yearly status reviews. Each type of review is described in this section. All reviews will be conducted according to the guidelines established in NASA publication SEL-84-101.

4.1.2.8.1 Requirements Review

The ATS requirements review will assess the completeness, clarity, and correctness of the ATS Project requirements. The review will identify applicability of system components to specific missions and will

verify the overall system design with respect to the current and future operations conducted at the multi-mission ATS station.

4.1.2.8.2 Design Reviews

The ATS Design Review will assess the applicability of the specific system design and implementation plan. This review will provide an external view of the project and will insure that implementation strategies and designs make maximum use and reuse of COTS and other available off the shelf systems.

4.1.2.8.3 Implementation/Status Reviews

The Implementation and Status Reviews will be held on a yearly basis and will provide management with a current status of all aspects of the project. Each review will identify areas of progress, areas of completion, areas of lag, and changes to requirements, schedule, budget, or functionality to be delivered. In addition, areas of reuse will be identified in terms of collaborative efforts within Code 452 as well as external to it.

4.1.2.8.4 System Readiness Review

The ATS System Readiness Review will be conducted at the conclusion of the final delivery phase and will establish that the system design and implementation has met the requirements and can be released for operational use. At this review a summary of the total budget and effort will be presented and will be contrasted with the base-lined original plans for metric analysis.

4.1.3 Incoming Inspection and Test

No inspection other than kind, count, and condition of purchased products is planned.

4.1.4 Control of Test Equipment

This section is not applicable, test equipment is owned by CSOC.

4.2 Process for Transportation, Identification, and Medium of Product

The NASA/GSFC center process for transportation will be used to transport all Automated Tracking Station products.

4.3 Technology and Commercialization Plan

There is no technology and commercialization plan at this time.

4.4 Servicing – Process for Product Maintenance

Servicing of all COTS hardware and software will be covered under the respective product warranties. Servicing of all GOTS software will be performed by the supplier of that software.

5.0 Product Assurance

This section describes the processes and procedures that will be followed in order to assure that the product developed satisfies the customer's requirements.

5.1 Assumptions and Constraints

It is assumed that all GOTS products employed in the Automated Tracking Station will be ISO 9001 compliant. The supplier of each GOTS product is expected to maintain quality records related to the product. It is assumed that all COTS products will meet or exceed all specifications included in the purchase request.

5.2 Quality Assurance

This section describes the processes and procedures that will be followed in order to assure that the customer receives a quality product.

5.2.1 Control of Non-Conforming Products

Non-conforming products will be reported using the NASA/GSFC Nonconformance Form found at (http://arioch.gsfc.nasa.gov/iso9000/word/gpg5340-2.pdf). Reports of nonconformance will be reviewed, tracked, and maintained by the development team. An assessment of the impact of the nonconformance to the schedule, budget, and delivery of the product will be made by the development team and reported to the customer.
Changes made to the system in response to a nonconformance report will be maintained by the Automated Tracking Station development team.

The customer will have the authority to use or refuse to use the product in an operational environment.

5.2.2 Corrective and Preventative Action

Error in process will be reported using the NASA/GSFC Nonconformance Form found at (http://arioch.gsfc.nasa.gov/iso9000/word/gpg5340-2.pdf). Reports of nonconformance will be reviewed, tracked, and maintained by the development team. An assessment of the impact of the nonconformance to the schedule, budget, and delivery of the product will be made by the development team and reported to the customer.

5.2.3 Control of Quality Records

All quality records associated with the Automated Tracking Station development effort will be controlled by the ATS Lead. A list of the quality records will be linked to the ATS web page at (http://www.wff.nasa.gov/~code584/awots.html).

5.2.4 Control of Documents and Data

All documents generated by the Automated Tracking Station development team are controlled by the ATS Lead. A list of quality records will be linked to the ATS web page at (http://www.wff.nasa.gov/awots.html).

5.3 Configuration Management

Configuration management procedures will be applied to all components delivered or developed during this effort and will be base-lined as of the start of the project. Subsequent builds or deliveries will result in incremental versions of the ATS system in any or all functional areas. Changes to archived software or installed software following the initial delivery will require approval of the ATS Project Lead prior to the system being accepted for integration.

5.3.1 Identification and Traceability of Products

A formal release form signed by the ATS development team, the Antenna COTR, Telemetry Engineers, the Engineering and Operations Interface, and the Automation Software Lead will become a part of the project's quality records. The release form will include an identification of components that comprise the released product as well as any known constraints or restrictions.

5.3.2 Control of Customer Supplied Elements

No customer supplied elements are anticipated.

6.0 Plan Update History

Version	Date	Description	Affected Pages
1.0	March 23, 1999	Original	All